Cherry Creek Draft Supplemental Environmental Assessment
June 2005

BACKGROUND

Montana Fish, Wildlife, & Parks (FWP) initiated the Cherry Creek Native Fish Introduction Project in 2003. The project was evaluated in 1998 through an FWP Environmental Assessment entitled Madison River Drainage Westslope Cutthroat Trout Conservation and Restoration Program: Cherry Creek Native Fish Introduction (Bramblett 1998), and again in 1999 by the Montana Department of Environmental Quality (DEQ) EA entitled Cherry Creek Native Fish Introduction (DEQ 1999). Impacts of the project on the human and physical environment were evaluated in both documents and no significant impacts were identified. Cherry Lake and approximately 11 miles of stream, together called "Phase 1", were treated in 2003 and 2004 with antimycin (brand name Fintrol). Because fish persist in Cherry Lake after the 2004 treatment, another treatment of Cherry Lake in 2005 is anticipated. The impacts of the actions proposed in this supplement are consistent with the impacts evaluated in the 1998 and 1999 assessments (including evaluation of the affects of rotenone and antimycin on the environment and human health), and though they were implied in the earlier documents, the actions proposed in this supplement - using rotenone in Cherry Lake - were not explicitly stated in those documents. Therefore FWP is conducting this supplement to its 1998 EA. This supplement is evaluating two items:

1. Concurrent with the regular antimycin treatment, use rotenone powder or liquid at specific sites of Cherry Lake to treat specific areas such as lakebed upwellings and a shallow grassy area on the lake margin, and
2. in the event the antimycin treatment is not successful in completing the fish eradication in Cherry Lake, conduct a full lake treatment with liquid and/or powdered rotenone.

The goal of the Cherry Creek Native Fish Introduction Project is to introduce westslope cutthroat trout, and possibly other native fish species, into over 60 stream miles of the Cherry Creek Drainage, a tributary to the lower Madison River. To accomplish this goal competing and hybridizing nonnative fish must be removed from streams within the project area, and from Cherry Lake at the head of the drainage. Cherry Lake holds approximately 105 acre-feet of water with a maximum depth of 35 feet. Removal of the nonnative fish is accomplished using fish pesticides (piscicides) that are approved specifically for this use by the Environmental Protection Agency (EPA). The active ingredients of the approved piscicides are antimycin or rotenone. Antimycin is commonly found in soil fungus, and is a derivative of streptomycin, an antibiotic. Antimyicin is applied to the waters in a liquid formulation. Rotenone is produced in derris, timbo, and barbasco plants, is commonly used in over-the-counter garden insecticides, and is used by aboriginal South Americans to harvest fish for consumption. Rotenone can be applied either as a liquid or as a dry powder. The powder formulation contains no carriers such as the petroleum products of liquid rotenone formulations.

The Cherry Creek project is designed to be conducted in no less than four phases. Each phase is a specific geographic portion of the drainage and will receive chemical treatments for at least two consecutive years.

PROJECT PROGRESS and CHALLENGES, 2003 – 2004

Chemical applications of antimycin were conducted in August 2003 and 2004 in Cherry Lake and approximately 11 miles of stream in the upper Cherry Creek Drainage. Stream treatments have been very successful. Antimycin has been applied to the stream at a concentration of 10 parts per billion (ppb). Based on sentinel fish held in mesh bags and observations of free-swimming fish, chemical distribution in the entire stream area is good. Though no fish were observed in electrofishing surveys conducted in July 2004, 18 fish were found in the streams during the scheduled second treatment of Phase 1 in August 2004. The areas where fish survived the 2003 treatments and were subsequently found in 2004 will be electrofished in July 2005. If evidence of surviving fish (fish or redds) is found, those specific areas will be treated again in 2005.

Cherry Lake was treated in 2003 and 2004, but the antimycin was applied differently in 2004 than in 2003. In both years, antimycin was dispersed into the lake by pumping a mixture of antimycin and lake water from a 14-gallon raft-mounted tank through a single outflow point on the application hose. In 2003, the lake was treated three separate times, each time the quantity of antimycin applied was 4 ppb so the cumulative total of the three treatments was 12 ppb. The 2003 treatments were conducted on August 4, 6, and 20. Gillnets set in the lake after the August 4 treatment captured 3 fish the night of August 5, so the second treatment was conducted. No fish were captured in gillnets through August 8, so personnel left the lake to assist with stream treatments. Fish were seen rising in the lake on August 9 by horse packers gathering equipment to remove from the lake. After all stream treatments were completed in 2003, personnel returned to the lake and captured two fish in gillnets the night of August 19. They then conducted another treatment of 4 ppb on August 20. In 2003, antimycin was applied to the surface waters of the lake as well as pumped to deeper portions of the lake. After determining that the 2003 treatment was not as successful as desired, we decided to apply the full quantity of antimycin to the lake on a single day in 2004. The treatment was conducted on August 1, 2004 so that 11 ppb were applied to the lake surface in a single day. Experience of U.S. Fish & Wildlife Service personnel in Colorado has shown that surface applications are successful in eradicating fish from small lakes because the fish spend enough time near the lake surface for feeding to receive a lethal dose of antimycin before the antimycin degrades. However, in Cherry Lake in 2004, few fish were observed to be killed by the treatment. Six gillnets were set on August 1 after the treatment and left in place to fish continuously. As of October 13, 2004, 57 fish were captured in the gillnets, 30 of those fish by the end of August. The nets were left to fish in the lake overwinter. Personnel were not able to access the lake after October 13 due to a combination of access restrictions on the Flying D Ranch and early season snow preventing efficient travel to the lake once the ranch was accessed.

ALTERNATIVES UNDER CONSIDERATION

No Action:

In the No Action alternative, Cherry Lake and its inlet streams would be treated in 2005 using only antimycin, as considered and approved in the 1998 EA. Therefore, this No Action alternative does not change the 1998 decision that allows the use of antimycin for 3-5 years. The objective of complete eradication of the resident Yellowstone cutthroat trout may be accomplished through this alternative, though Cherry Lake retained fish after the 2003 and 2004 treatments. Although fish cannot detect antimycin, if significant upwellings of untreated water exist on the lake bottom, some fish may avoid the full effect of the treatment.

Preferred Action:
Use liquid or powdered rotenone to treat a shallow grassy area on the west side of Cherry Lake and if significant lakebed upwellings are found during SCUBA surveys, treat the upwelling water with powdered rotenone. The use of rotenone would be conducted concurrently and in addition to treating Cherry Lake, its inlet streams, and a short section of its outlet stream with antimycin, as described in FWP's 1998 EA and conducted in 2003 and 2004.

Under this alternative, the lake will be treated with antimycin in 2005 at the same concentration and with the same equipment used in 2003 and 2004, but with a modified application nozzle to allow broader and deeper dispersal, and with the application occurring in the evening rather than the morning, which will reduce the photodegradation rate of the antimycin.

If significant lake-bottom upwellings are found, a dry rotenone gel formulation will be set on each at the time the lake is treated with antimycin. Based on comparison of lake inflow versus lake outflow, it is unlikely that a large volume of groundwater is upwelling in the lake. The dry rotenone formulation does not contain petroleum carriers like the liquid formulations, so will not be detectible by fish. Dry rotenone is mixed with gelatin and sand into a dough-like consistency, then formed into 'doughballs' or placed in containers, such as burlap bags or plastic buckets with holes in them, and placed in the target water. In Cherry Lake, this dry rotenone formulation would likely be placed in plastic buckets and set directly on any upwellings immediately prior to the body of the lake being treated with antimycin.

A shallow grassy area on the west side of the lake will be treated with liquid or powdered rotenone to target any juvenile fish that may be rearing in that area. Rotenone is more effective than antimycin in areas with abundant vegetation or organic matter.

The treatment is expected to occur in early August. If the early August antimycin treatment is not fully successful as determined by at least two weeks of monitoring with nets and traps, a second treatment of the lake may occur in mid or late August using liquid rotenone in the body of the lake and possibly powdered rotenone on lakebed upwellings. If the second treatment is necessary, the concentration of rotenone formulation in the lake would not exceed 1.0 ppm as described in FWP's 1998 EA.

All other project treatment schedules and methods in Phase 1 and Phase 2 will follow the standard operating procedures established in 2003 and 2004, using antimycin in August, as approved in the 1998 EA.

A detoxification station will be set and ready to activate in the event that piscicides from the lake remain active for a greater downstream distance than anticipated. The detoxification station will be located at the Phase 2 endpoint, approximately 7.6 stream miles and 2630 feet elevation below the lake.

IMPACTS OF PROPOSED ACTIONS

The 1999 DEQ EA concluded there is no significant effect on human health or the environment from the proper use of antimycin or rotenone. Appeals to the Montana Board of Environmental Review, Montana District Court, and U.S. District Court have all upheld DEQ and FWP decisions and actions in conducting the project.

The action proposed in this supplement poses no primary, secondary, or cumulative impacts that were not addressed in the 1998 FWP EA and 1999 DEQ EA. These documents analyzed the impacts of the application of rotenone and antimycin in waters generally, and specifically in the waters of the Cherry Creek Drainage, which includes Cherry Lake.

Attachment A contains a more detailed description and analyses regarding the health and environmental impacts of the application of rotenone and antimycin to waters generally, and more specifically the application of rotenone and antimycin to the waters of the Cherry Creek Drainage, which includes Cherry Lake. Attachment B contains labels for liquid and dry rotenone and antimycin.

CONCLUSION

Based on the criteria evaluated in the 1998 EA and this supplement to that EA, an Environmental Impact Statement (EIS) is not required because the actions proposed in this supplement lack significant effects on the physical and human environment. The impacts detailed in this supplement are consistent and complimentary with those determined by the 1998 EA, namely the removal of non-native fish (Yellowstone cutthroat trout) from Cherry Lake to allow the subsequent introduction of native fish (westslope cutthroat trout) without the threat of hybridization.

PUBLIC INVOLVEMENT

Public involvement appropriate for this supplement is a three (3) week public comment period. The 1998 EA provided a 45-day public scoping period including three open public scoping meetings (Bozeman, Ennis, Three Forks) prior to release of the EA. After release of the EA a 32-day public comment period and three public meetings (Three Forks, Bozeman, and Butte) were available for public comment.

A three (3) week public comment period is open from June 30, 2005 to July 21, 2005. Written comments should be sent to:

Montana Fish, Wildlife & Parks
c/o Cherry Creek Supplement
Box 1336
Ennis, MT 59729

Or by email to pclancey@mt.gov

Name, title, address, and phone number of the person(s) responsible for preparing the EA:

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ATTACHMENT A

DISCUSSION OF EFFECTS OF ROTENONE, ANTIMYCIN, AND POTASSIUM PERMANGANATE ON WATER RESOURCES, NON-TARGET ORGANISMS, AND HUMAN HEALTH

(Information provided by the Montana Department of Environmental Quality, Montana Fish, Wildlife, & Parks, and Turner Enterprises, Inc.)

Direct and Indirect Effects on Water Resources

Water quantity would not be affected by the proposed action. The effects on water quality from the application of piscicides would be temporary and would become undetectable after a short time.

No contamination of groundwater is anticipated to result from this project. The piscicides bind readily to sediments, which suggests that they would not seep into groundwater aquifers (Skaar, 2002; Engstrom-Heg, 1971, 1976). In California, monitoring of wells in aquifers adjacent to and downstream of rotenone applications did not detected rotenone or any of the other organic compounds in the formulated products (CDFG, 1994). Case studies in Montana have concluded that rotenone movement through ground water is minimal. At Tetrault Lake Montana, rotenone was not detected in a nearby domestic well, which was sampled two and four weeks after treatment of the lake with 90 ppb active rotenone. This well was chosen because it was down gradient from the lake and also drew water from the same aquifer that fed and drained the lake. In 1998, a Kalispell area pond was treated with rotenone. Water from a well, located 65 feet from the pond, was analyzed and no sign of rotenone was detected. In 2001, another Kalispell area pond was treated with rotenone. Water from a well located 200 feet from that pond was tested four times over a 21-day period and showed no sign of contamination.

A number of factors will aid in reducing or eliminating public exposure to the compounds including proper containment of piscicide treatments, the low concentrations used do not have harmful effects on mammals, rapid detoxification of both compounds in flowing streams, and signing at trailheads will allow users to find alternate sources for water, if necessary. The closest municipal water intake is the Town of Three Forks, which takes their municipal water from wells, not from surface water. This form of water intake further reduces any exposure to humans. By the time source waters reach municipal locations, adequate dilution and natural detoxification has taken place. The 1999 DEQ EA evaluated the potential affect of rotenone and antimycin on the Three Forks water supply, and concluded "The analyses (for antimycin and rotenone) demonstrate that there would be no effect on human health even if the chemicals were not detoxified, did not breakdown, and people drank the affected water continuously for their entire lives. In fact, the chemicals would breakdown and no one would drink the affected water continuously because the application of the chemical would be limited to a matter of 2-3 weeks per year… .". Additionally, the portion of Three Forks water taken from the Madison Drainage is from deep aquifers, which are not hydrologically connected to the Madison River. In FWP's 1998 EA, we anticipated using a maximum of 10 gallons of liquid rotenone cumulatively in Carpenter, Mill, and the East Fork of Cherry creeks, which the above DEQ conclusions are based on. Cherry Lake is 13½ stream miles and 3100 feet in elevation above the mouth of Mill Creek, the stream in the project that may be treated with liquid rotenone that is nearest Three Forks. The mouth of Mill Creek is approximately 32½ stream miles (Cherry Creek + Madison River) and 1400 feet in elevation above Interstate 90 near Three Forks. Cherry Creek water will be diluted at least 35-fold, more likely 55-fold, once it enters the Madison River because minimum discharge in that area of the Madison River is 1100 cfs, while Cherry Creek discharge at its confluence with the river is typically less than 20 cfs. The quantity of rotenone, if any, that would be used at Cherry Lake in 2005 is expected to be 35 gallons of liquid formulation and less than 1 pound of dry formulation.

Affect on non-target wildlife resources

The 1998 EA detailed the impact of the piscicides on non-target wildlife resources. In 2003 and 2004, juveniles and adults of two amphibian species, spotted frogs and boreal toads, were present during August treatments of the lake and streams. In some instances, the spotted frog larvae did not succumb when exposed to the antimycin, possibly due to an advanced stage of development during which they gulp air as their lungs develop. We noted adults of both species were unaffected by the treatments, and in 2004 there were numerous tadpoles of each species in the treatment area, indicating successful reproduction of each species in 2004.

On-going bioassays by TEI reveal that spotted frog tadpoles below Gosner developmental stage 27 suffer 100 percent mortality when exposed to antimycin concentration of 10 ppb, but above Gosner stage 27, approximately 100 ppb are necessary to cause mortality. Similarly, boreal toad tadpoles below Gosner stage 27 – 30 exhibit less than 100 % percent mortality at treatment level concentrations, and once beyond stage 27-30, exhibit even less mortality at 100 ppb antimycin.

Aquatic invertebrates were monitored in 2003 and 2004 prior to and following antimycin treatments in the stream (Table 1). The density of invertebrates at monitoring stations did not exhibit a consistent reaction to the chemical treatments. For instance, in 2003, two of three stations exhibited a decline in total abundance after treatment, while in 2004, all three stations and the control site exhibited increased total abundance after treatment.

Table 1. Total abundance (number per square meter) of aquatic invertebrates at Cherry Creek monitoring sites prior to and following antimycin application.

Sample site	2003			2004		
	pretreat	posttreat	% change	pretreat	posttreat	% change
CH01	2238	2376	+ 6.2	901	1917	+ 112.8
CH02	1717	1037	-39.6	1504	1706	+ 13.4
CH03	1780	874	-50.9	668	838	+ 25.4
Control	NA	NA		595	975	+ 63.9

Human Health

Although pesticides are used widely to control unwanted species, legitimate public concerns have been raised regarding the safety and health effects to humans. As with any pesticide, people directly exposed to or who consume the pesticide at full strength can experience harmful or sometimes fatal effects. Rotenone and antimycin are EPA registered pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

<u>Rotenone</u>

There are no federal or Montana numeric water quality standards for rotenone, however DEQ used the EPA method of calculating human health criteria to estimate a safe level for life long exposure to water and the consumption of fish exposed to water containing rotenone.
Using the EPA method of calculating the human health criteria based on noncarcinogenic effects, a safe level for life-long exposure to water containing rotenone and eating fish from those waters is 40μg/L. The calculation is based on several assumptions:

- Long-term (70 years) exposure
- Average body mass of 70 kg (154 pounds) (BW)
- A person consumes 2 L (8 cups) of treated water per day (DI)

- A person consumes 0.0065 kg (0.23 ounces) of fish per day (FI)
- Reference Dose (RfD) for rotenone = 0.004 mg/kg-day (EPA, Integrated Risk Information System (IRIS))

Some chemicals tend to increase in fish tissue over the concentration in the water, or bio-concentrate. The amount the chemical increases in the fish relative to the ambient concentration is the bio-concentration factor (BCF). The BCF does not include possible food chain affects. The calculation of the rotenone criteria is as follows:

[0.004 mg/kg-day (RfD) * 70 kg (BW)]/
[2 L/day (DI) + (0.0065 kg/day (FI) * 770 L/kg (BCF)]

The rotenone formulation that would be used, called Prenfish, contains 5.0 percent active ingredient. When the formulation is applied to achieve 1 ppm (mg/l) in the water body, the active ingredient concentration is 0.05 mg/l, or 50 μg/l. The target concentration would be 10 μg/l above the calculated long-term safe level. But the long-term safe level was determined using the standard assumption that fish would be exposed to rotenone and be able to bio-concentrate rotenone, which is an extremely protective assumption. Rotenone is a natural chemical but is not naturally found in Montana and is not likely to be found in fish that are commercially available for consumption. Fish exposed to rotenone at the target concentration will be dead within a matter of hours, so bio-concentration is very unlikely. Most of the fish in the treated lakes will sink to the bottom and any fish that do surface will be eviscerated and sunk back into the deepest portion of the lake. The potential long-term risk to humans with water as the only source of rotenone exposure yields 140 μg/l as a safe long-term concentration. Since rotenone concentration in tissue and water declines quickly after a treatment, and people would not likely be exposed to treatments continually, hazardous life-long exposure to rotenone is extremely unlikely.

In addition to the 5.0 percent active ingredient rotenone, Prenfish contains 10.0 percent associated resins and 85 percent inert ingredients (including aromatic hydrocarbons). In the event that a lakewide treatment using Prenfish is necessary, we anticipate using less than 50 gallons. For instance, treating the 105 acre-foot Cherry Lake to 1.0 ppm would require 35 gallons of Prenfish, which would result in a lakewide concentration of 50 μg/L (ppb) active ingredient rotenone.

The dry rotenone formulation proposed for use at Cherry Lake, called Rotenone Fish Toxicant Powder (RTFP), contains 7.4 percent active ingredient, 11.1 percent associated resins, and 81.5 percent inert ingredients. There are no petroleum carriers in the dry formulation as there are in the liquid formulations. One pound of RTFP will treat 0.37 acre-foot of water to 1 ppm (mg/L), resulting in a concentration of 50 μg/L active ingredient rotenone. It is extremely unlikely we will find a significant volume of upwellings in the lake. The greatest measured difference between lake inflow and lake outflow during treatments in 2003 and 2004 was 0.12 cubic-feet per second (cfs) (0.27 cfs outflow vs 0.15 cfs inflow). One cfs is 449 gallons per minute. For this analysis, the difference between inflow and outflow is attributed to lakebed upwellings, and is equivalent to 0.010 acre-feet/hour. So to treat 0.010 a-f/hour for 8 hours (0.08 a-f) to a concentration of 1 ppm (mg/L) RTFP would require 0.22 pounds RTFP, resulting in a lakewide concentration of 0.0001 μg/L active ingredient rotenone.

In the event that a lakewide rotenone treatment is necessary using 0.22 pounds of dry rotenone on lakebed upwellings and 35 gallons of liquid rotenone, the lakewide concentration of rotenone would be 50.0001 μg/L.

Public health issues surrounding the use of rotenone have been studied extensively. In general, the EPA, through the FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) registration process, has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment (Finlayson et al. 2000) as long as the product label instructions are followed.

In their description of how South American Indians prepare and apply *Timbó*, a rotenone parent plant, Teixeira et al. (1984) reported that the Indians extensively handled the plants during a mastication process, and then distributed the plant pulp in lagoons to harvest fish by swimming with it on their backs. No harmful effects were reported.

Finlayson et al. (2000) reported that the EPA "has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment." In relation to air quality, they further note "No public health effects from rotenone use as a piscicide have been reported." No waiting period is specified for swimming in rotenone-treated water.

Aside from the rotenone itself, liquid formulations also consist of petroleum emulsifiers. Finlayson (2000) wrote regarding the health risks of these constituent elements:
" . . . the EPA has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment. The California Environmental Protection Agency found that adverse impacts from properly conducted, legal uses of liquid rotenone formulations in prescribed fish management projects were nonexistent or within acceptable levels (memorandum from J. Wells, California Department of Pesticide Regulation, to Finlayson, 3 August 1993). Liquid rotenone contains the carcinogen trichloroethylene (TCE). However, the TCE concentration in water immediately following treatment (less than 0.005 mg TCE per liter of water [5 ppb]) does not exceed the level permissible in drinking water (0.005 mg TCE per liter of water, USEPA 1980b). None of the other materials including xylenes, naphthalene, piperonyl butoxide, and methylnaphthalenes exceed any water quality criteria guidelines (based on lifetime exposure) set by the USEPA (1980a, 1981a, 1993). Many of these materials in the liquid rotenone formulations (trichloroethylene, naphthalene, and xylene) are the same as those found in fuel oil and are present in waters everywhere because of the frequent use of outboard motors . . ."

CDFG (1994) calculated that the maximum expected level of these contaminants following a treatment level of 2 ppm formulation are TCE 1.1 ppb; toluene 84 ppb; xylenes 3.4 ppb; naphthalene 140 ppb. If used at Cherry Lake, the treatment level will not exceed 1 ppm formulation.

The product label states:
"*. . . do not use dead fish for food or feed, do not use water treated with rotenone to irrigate crops or release within ½ mile upstream of a potable water or irrigation water intake in a standing body of water such as a lake, pond, or reservoir. . . . do not allow swimming in rotenone treated water until the application has been completed and all pesticide has been thoroughly mixed into the water according to the labeling instructions. This product is flammable and should be kept away from heat and open flame . . .*"

The major risks to human health from rotenone come from accidental exposure during application. This is the only time when humans are exposed to concentrations that are greater than that needed to remove fish. To prevent accidental exposure to rotenone, the Montana Department of Agriculture requires applicators to be:

- trained and certified to apply the pesticide in use
- equipped with the proper safety gear which includes a fitted respirator, eye protection, rubberized gloves, hazardous material suit
- have product labels with them during use
- contain materials only in approved containers that are properly labeled
- adhere to the product label requirements for storage, handling, and application

Any threats to human health during application can be greatly reduced with proper use of safety equipment. Recreationists in the area would likely not be exposed to the treatments. Proper warning through news releases, signing at trailheads, and administrative personnel in the project area should be adequate to keep recreationists from being exposed to any treated waters. A freshwater spring near Cherry Lake serves a source of untreated consumable water for project workers, and for any recreationists who encounter the treatment area. No recreationists were encountered in the area during antimycin treatments in 2003 and 2004.

Antimycin

There are no federal or Montana numeric water quality standards for antimycin. The sub-chronic effects to humans from antimycin exposure can be derived from studies in which rats were exposed to varying levels of antimycin for 90 days (Kuhn 2001, Herr et al 1967). The authors found no effects (mortality, body weights, food consumption, hematology, histopathology, clinical chemistry) (No-Observed-Adverse-Effect Level, NOAEL) at a dose level of 0.5 mg/kg/day.

It is appropriate to develop a sub-chronic criteria in this case because the chemical will be used only once in the lake and each stream section and the chemical breaks down in a matter of a few days (extremely shorter timeframe than chronic conditions). Using the EPA methodology of calculating human health criteria, an estimate of a safe sub-chronic exposure to water containing antimycin is 59.5µg/L

The calculation is based on several assumptions:

- Sub-Chronic Reference Dose (RfD) for antimycin = 0.0017 mg/kg-day
- Average body mass of 70 kg (BW)
- A person consumes 2 L of treated water per day (DI)

The EPA has not published an RfD for antimycin in the Integrated Risk Information System. For this project a sub-chronic RfD was calculated using the NOAEL above and three separate uncertainty factors:

1) a factor of 10 based on the uncertainty in the animal to human translation
2) a factor of 10 based on average human to sensitive human uncertainty, and
3) a factor of 3 based on the limited number of studies.

The estimated RfD is (0.5 mg/kg-day)/(10*10*3) = 0.0017 mg/kg-day

Some chemicals tend to increase in fish tissue over the concentration in the water, or bio-concentrate. The amount the chemical increases in the fish relative to the ambient concentration

is the bio-concentration factor (BCF). The BCF does not include possible food chain affects. Antimycin has not been shown to bio-concentrate to levels where harmful affects are anticipated. Ritter and Strong (1966) reported that twenty-one humans associated with their study consumed between 1 and 5 four ounce servings of fish killed by antimycin and suffered no ill effects. Based on this, they concluded that antimycin-killed fish would be safe as human food. Schnick (1974a) reported that antimycin is not hazardous to humans whether it is consumed in water or food. Therefore, a BCF was not used in the calculation of the sub-chronic exposure criteria.

The calculation of the antimycin criteria is as follows:

(0.5 mg/kg-day (RfD) * 70 kg (BW))/(2 L/day (DI))

Based on a maximum concentration of 12 ppb that will be used in this project, the maximum concentration that would occur in Cherry Lake is 12 μg/L, which is 1,458 times less than the safe level calculated by DEQ. This is the same concentration that has been used in Cherry Lake in 2003 and 2004.

As with rotenone, the major threat to human health resulting from the use of antimycin is from accidental exposure to abnormally high concentrate during application. To avoid this, applicators are cautioned by the product label, and required by the Montana Department of Agriculture, to use protective clothing and equipment.

Antimycin is produced in two components (labels in Attachment B), a Concentrate and a Diluent, that must be mixed in equal proportions prior to applying to the water. The Concentrate is composed of the active ingredient, Antimycin A (23%) and inert ingredients Soy lipids (15%) and acetone (62%). The Concentrate label states… *"WARNING: May be fatal if swallowed or absorbed through the skin. Causes substantial but temporary eye injury. Causes skin irritation. Do not breathe spray mist. Do not get in eyes, on skin or on clothing. Wear protective goggles. Wear chemical gloves. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco. Remove contaminated clothing and wash before reuse."*

The Diluent is composed of inert ingredients diethyl phthalate surfactant (30.5%), nonoxynol-9 detergent (16.7%), and acetone (52.8%). The Diluent label states …*"CAUTION: Harmful if swallowed. Harmful if inhaled. Harmful if absorbed through skin. Causes moderate eye irritation. Avoid contact with skin and clothing. Do not breathe spray mist. Do not get in eyes, on skin or on clothing. Wear protective goggles. Wear chemical gloves. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco. Remove contaminated clothing and wash before reuse."*

The combined ingredients of the two components of Fintrol are the active ingredient antimycin (11.5 percent), and inert ingredients soy lipids (7.5 percent), diethyl phthalate (surfactant) (15.25 percent), nonoxynol –9 (detergent) (8.35 percent), and acetone (57.4 percent).

The acute toxicity (short-term dose) of antimycin to humans is unknown.

Table 2 compares the concentration of Fintrol's inactive ingredients with human health criteria for a treatment concentration of 10 ppb (μg/L).

Table 2. Human health criteria versus Fintol inactive ingredient concentration for a 10 ppb concentration (data from Montana DEQ).

Carrier chemical	Concentration	WQ std.	RfD	Estimated criteria
Acetone	65 μg/L	NE	0.9mg/kg-day	31,500μg/L
Nonylphenol polyglycol ether	12.5 μg/L	NE	NE	
Diethyl phthalate	7 μg/L	23,000 μg/L		

NE = Not established

Nonoxyl-9 [nonylphenol polyglycol ether] is used in antimycin formulations to make the solution more soluble in water. It is a detergent developed in the early part of the 20th century as a solution for cleaning hospital surfaces. Determined to be an effective spermicide, it became a leading component in lubes, condom lubricants and contraceptive films. It is used as an ingredient in skin lotions, scar crèmes, and post medical treatment skin cremes, but is a powerful irritant to internal body surfaces. Skaar (2002) writes: "The nonylphenol polyglycol ether does contain some residual amount of ethylene oxide (maximum of 5 mg/L) which is a potential carcinogen. Under a typical treatment level of 10 μg /L antimycin, the maximum level of ethylene oxide introduced into the water would be 62.5 pg/L this compound has a very low vapor pressure and is expected to volatilize immediately upon application. There are no water quality standards for this chemical. The little bit of toxicological information available on rats suggests that this concentration is far below one that would have an effect on any mammal drinking from an antimycin-treated stream or lake. The ATSDR Public Health Statement (1990) states that rats are killed in one day by a 4,000 μg /g dose in the food. A dose of 2,000 μg /g for 21-30 days caused liver damage and stomach irritation. This Statement also says that ethylene oxide in water will either breakdown or be destroyed by bacteria within a few days, suggesting that long-term exposure to this chemical is not possible."

The Fish Toxicant Kit Use Direction Leaflet that accompanies the antimycin label states: *"Fish killed with antimycin A should not be consumed by man or animals. Treated waters should not be used for drinking by man or animals, or for crop irrigation, until fingerling rainbow trout or fingerling bluegills survive 48 hours exposure in live cars in the treated waters. Leftover portions of mixed liquid retain potency for 7 days. But once water has been added to FINTROL-CONCENTRATE, it must be used within 8 hours to ensure potency. Due to its acetone component, FINTROL-CONCENTRATE is flammable: keep away from heat and flame."*

Potassium Permanganate

Because potassium permanganate is a strong oxidizing agent, care must be taken when handling the product. Permanganate is considered a "hazardous chemical" because it can react with certain reducing agents and generate heat. The human health hazards on the Material Safety Data Sheet (MSDS) lists it as an irritant to eyes, skin, respiratory system, and gastro intestinal tract. When handled properly, it is safer than other commonly used oxidants.

Similar to rotenone and antimycin, human health threats from potassium permanganate result from accidental exposure to unusually high concentrations. Using proper safety equipment including eye protection, respirators, rubber gloves, and protective clothing can reduce these threats. Recreationists in the area would likely not be exposed to the treatments because the application of potassium permanganate will occur on private property within the project area. Proper warning will also be made through news releases and signing at trailheads and by personnel working in the project area.

ATTACHMENT B

ROTENONE AND ANTIMYCIN LABELS

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